

APPENDIX A.—ASSUMPTIONS AND METHODS UNDERLYING THE MEDIUM-RANGE AND LONG-RANGE COST ESTIMATES

This appendix describes the assumptions and methods which underlie the medium-range and long-range cost estimates in this report. All descriptions pertain to the estimates under each of alternatives I, II-A, II-B, and III unless specifically stated otherwise. The basic assumptions comprising each alternative have been summarized in an earlier section entitled "Economic and Demographic Assumptions" and thus will be discussed here only in the context of the methods used. Further details about the assumptions, methods, and cost estimates are published periodically in Actuarial Studies prepared by the Office of the Actuary, Social Security Administration.

TOTAL POPULATION

Projections were made of the U.S. population (including persons overseas covered by the OASDI program) by age, sex, and marital status for future years to 2055. The starting point was the population on July 1, 1979 as estimated by the Bureau of the Census from the 1970 Census and from births, deaths, and net immigration during 1970-79. This population estimate was adjusted for net census undercount and was increased by the estimated populations in the geographic areas covered by the OASDI program but not included in the estimate made by the Bureau of the Census. The population in future years was then projected from assumed rates of birth and death and assumed net immigration.

Historically, fertility rates in the United States have fluctuated widely. The total fertility rate (which for a given year is the number of children that a woman would have during her lifetime if she were to survive the childbearing period and were to experience the age-specific birth rates observed in that year) decreased from 3.3 after World War I to 2.1 during the Great Depression, rose to about 3.7 in 1957 and then fell to 1.7 in 1976. Since that time, the total fertility rate has fluctuated around 1.8 children per woman.

The historical variations in fertility rates have resulted from changes in social attitudes, economic conditions, and medical knowledge. After considering the recent behavior and trends of these factors, ultimate total fertility rates of 2.4, 2.1, 2.1, and 1.7 children per woman were selected for alternatives I, II-A, II-B, and III, respectively. For each alternative, the total fertility rate was projected from its estimated level in 1980 to its ultimate level in 2005 by linear interpolation. These ultimate values can be compared with those used by the Bureau of the Census in its latest series of population projections.¹ The Bureau of the Census used a range of 1.7 to 2.7, with an intermediate assumption of 2.1, as is used in alternatives II-A and II-B. This rate of 2.1 is the rate which would result in a constant population if there were no net migration and if mortality were constant at levels close to current U.S. levels.

Historically, mortality rates in the United States have improved steadily. For a given year, the age-adjusted death rate for men is that rate which, when applied to the enumerated total male population as of April 1, 1970, gives the same number of deaths that results from applying

¹U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 704, "Projections of the Population of the United States: 1977-2050," U.S. Government Printing Office, Washington, D.C., 1977.

the age-specific death rates for men for the given year to the same population by age. The age-adjusted death rate for women is determined analogously. Such rate for both men and women has been improving an average of 1.2 percent per year since 1900. This improvement has resulted from many factors, including increased medical knowledge, increased availability of health-care services, and improvements in personal health-care practices such as diet and exercise.

The mortality assumptions in alternatives II-A and II-B (which are identical) were developed after taking the above factors into consideration. First, ultimate percentage improvements in death rates by sex and cause of death were selected. Then the annual percentage improvements by age, sex, and cause of death were projected by a logarithmic formula from their average values during 1968-78 to their ultimate values in 2005. As shown in Table A1, the resulting average annual improvement in the age-adjusted death rate during 1978-2055 is 0.59 percent, or about 49 percent of the observed average annual improvement during 1900-78. The average annual improvement for women is projected to be generally more than that for men, although the relative difference is less than observed during 1900-78.

TABLE A1.—PROJECTED AVERAGE ANNUAL MORTALITY IMPROVEMENT DURING 1978 TO 2055 UNDER ALTERNATIVES II-A AND II-B AND COMPARISON TO OBSERVED AVERAGE ANNUAL IMPROVEMENT DURING 1900 TO 1978

Sex and age	Adjusted death rate ^a (per 100,000)			Average annual improvement (percent)		1978-2055 improve- ment as ratio to 1900-78 improve- ment
	1900	1978	2055	1900-78	1978-2055	
Men:						
Under 15	1,836.8	144.0	87.8	3.21	0.64	0.20
15-24	590.0	172.0	150.1	1.57	.18	.11
25-64	1,502.7	736.8	467.3	.91	.59	.65
65 and over.....	9,542.3	6,741.4	4,469.0	.44	.53	1.20
Total.....	2,229.7	1,061.0	698.2	.95	.54	.57
Women:						
Under 15	1,606.5	109.5	62.0	3.38	.74	.22
15-24	580.0	60.5	45.3	2.86	.37	.13
25-64	1,380.8	379.4	243.8	1.64	.57	.35
65 and over.....	8,799.3	4,064.5	2,362.2	.99	.70	.71
Total.....	2,035.4	609.9	366.1	1.53	.66	.43
Total:						
Under 15	1,723.8	127.1	75.1	3.29	.68	.21
15-24	585.0	115.8	97.2	2.06	.23	.11
25-64	1,439.8	552.3	531.9	1.22	.58	.48
65 and over.....	9,110.2	5,184.7	3,243.8	.72	.61	.84
Total.....	2,130.0	829.5	527.7	1.20	.59	.49

^aAdjusted by the "direct" method, using the enumerated total population of the United States on April 1, 1970 as the standard.

Note: The definitions of alternatives II-A and II-B are presented in the text.

The mortality assumptions in alternative I reflect average annual improvements in the death rates by age and sex of half as much as those in alternatives II-A and II-B, while in alternative III they are twice as much.

Net immigration was assumed to be 400,000 persons per year in all four alternatives. The assumed net immigration does not include aliens entering the United States illegally, largely because no reliable estimate of their number exists. However, illegal aliens as enumerated in the 1970 Census were included in the starting population.

Table A2 shows the projected population by broad age groups under all four alternatives. Because many categories of OASDI benefits depend upon marital status, the population was also projected by marital status in addition to age and sex. Marriage rates and divorce rates were based on recent data from the National Center for Health Statistics.

TABLE A2.—SOCIAL SECURITY AREA POPULATION AS OF JULY 1 AND DEPENDENCY RATIOS BY BROAD AGE GROUP UNDER ALTERNATIVES I, II-A, II-B, AND III, CALENDAR YEARS 1960-2055

Calendar year	Population (in thousands)				Dependency ratio	
	Under 20	20-64	65 and over	Total	Aged ^a	Total ^b
1960	73,116	98,687	17,146	188,949	0.174	0.915
1965	79,931	104,112	18,963	203,006	.182	.950
1970	80,637	112,500	20,655	213,792	.184	.900
1975	77,947	122,036	23,092	223,075	.189	.828
1976	77,039	124,145	23,635	224,818	.190	.811
1977	76,420	126,200	24,166	226,787	.191	.797
1978	75,545	128,416	24,724	228,685	.193	.781
1979	74,734	130,579	25,328	230,640	.194	.766
1980	74,045	132,731	25,892	232,668	.195	.753
Alternative I:						
1985	72,544	142,471	28,638	243,653	.201	.710
1990	74,692	148,834	31,599	255,125	.212	.714
1995	78,055	154,233	33,712	266,001	.219	.725
2000	81,414	160,063	34,651	276,127	.216	.725
2005	83,580	167,312	35,578	286,470	.213	.712
2010	86,178	173,139	38,171	297,488	.220	.718
2015	89,789	175,977	42,975	308,741	.244	.754
2020	94,000	176,948	48,767	319,715	.276	.807
2025	97,720	177,582	54,917	330,220	.309	.860
2030	100,879	180,157	59,479	340,514	.330	.890
2035	104,208	185,911	60,772	350,891	.327	.887
2040	108,086	193,160	60,211	361,457	.312	.871
2045	112,347	200,747	59,218	372,312	.295	.855
2050	116,557	207,264	59,915	383,735	.289	.851
2055	120,567	214,037	61,497	396,101	.287	.851
Alternatives II-A and II-B:						
1985	72,252	142,531	28,773	243,556	.202	.709
1990	73,529	149,044	32,106	254,678	.215	.709
1995	75,506	154,640	34,745	264,891	.225	.713
2000	77,001	160,695	36,251	273,947	.226	.705
2005	76,957	167,890	37,719	282,566	.225	.683
2010	77,273	173,062	40,846	291,182	.236	.683
2015	78,570	174,678	46,225	299,473	.265	.714
2020	80,376	173,902	52,653	306,931	.303	.765
2025	81,720	172,107	59,539	313,366	.346	.821
2030	82,453	171,598	64,925	318,977	.378	.859
2035	83,151	173,803	67,044	323,997	.386	.864
2040	84,235	177,012	67,257	328,504	.380	.856
2045	85,604	180,037	66,922	332,562	.372	.847
2050	86,889	181,582	67,942	336,412	.374	.853
2055	87,921	183,192	69,293	340,406	.378	.858

TABLE A2.—SOCIAL SECURITY AREA POPULATION AS OF JULY 1 AND DEPENDENCY RATIOS BY BROAD AGE GROUP UNDER ALTERNATIVES I, II-A, II-B, AND III, CALENDAR YEARS 1960-2055 (Cont.)

Calendar year	Population (in thousands)			Total	Dependency ratio	
	Under 20	20-64	65 and over		Aged ¹	Total ²
Alternative III:						
1985.....	71,868	142,644	29,033	243,545	.204	.707
1990.....	71,993	149,425	33,080	254,498	.221	.703
1995.....	72,129	155,355	36,747	264,231	.237	.701
2000.....	71,141	161,776	39,409	272,327	.244	.683
2005.....	68,182	168,966	42,034	279,181	.249	.652
2010.....	65,598	173,318	46,337	285,252	.267	.646
2015.....	64,138	173,331	52,970	290,439	.306	.676
2020.....	63,283	170,229	60,755	294,268	.357	.729
2025.....	62,211	165,202	69,170	296,584	.419	.795
2030.....	60,641	160,684	76,250	297,575	.475	.852
2035.....	58,922	158,429	80,126	297,477	.506	.878
2040.....	57,538	156,715	82,119	296,372	.524	.891
2045.....	56,488	154,324	83,473	294,285	.541	.907
2050.....	55,486	150,147	85,728	291,361	.571	.941
2055.....	54,347	146,106	87,430	287,883	.598	.970

¹Population aged 65 and over as ratio to population aged 20-64.

²Population aged 65 and over plus population under age 20 as ratio to population aged 20-64.

Note: The definitions of alternatives I, II-A, II-B, and III are presented in the text.

A more thorough discussion of the population projections is shown in an Actuarial Study published by the Social Security Administration.¹

COVERED POPULATION

The covered population for any year is the number of people who work in covered employment at any time during the year. Projections of the covered population were made by applying projected coverage rates by age and sex to the corresponding number of people in the total population. The coverage rates—i.e., the percentages of the total population who work in covered employment during the year—were projected by age and sex from the unemployment rates and labor force participation rates, based on the relationships existing among those rates in 1970-76.

Unemployment rates by age and sex were projected on the basis of their relationships with the total unemployment rate since 1968. The total unemployment rate has averaged about 5.5 percent for the last 25 years and 6.4 percent for the last 10 years. The ultimate total unemployment rate was assumed to be 4.0, 5.0, 5.0, and 6.0 percent in alternatives I, II-A, II-B, and III, respectively. For each alternative, the total unemployment rates assumed for the early years of the projection period are consistent with the other assumptions in the alternative.

Labor force participation rates by age and sex were projected on the basis of historical data since 1960. In alternative II-A, the resulting ultimate age-adjusted rates for men reflect a decrease of 0.2 percentage points from the 1980 level of 78.1 percent, while the rates for women reflect an increase of 8.6 percentage points from the 1980 level of 51.2 percent. The assumed ultimate rates by age for women are about 77 percent of those for men, on the average for all ages combined. For both sexes, the ultimate rates are assumed to be attained by 2000. In alternative II-B, the resulting ultimate age-adjusted rates for men reflect

¹Joseph F. Faber and John C. Wilkin, F.S.A., *Social Security Area Population Projections, 1981*, Actuarial Study No. 85 (U.S. Department of Health and Human Services, SSA Publication No. 11-11532, July 1981).

a decrease of 0.4 percent from the 1980 level, while the rates for women reflect an increase of 8.4 percent from the 1980 level. The assumed ultimate rates by age for women average about 74 percent of those for men. For both sexes, the ultimate rates are assumed to be attained by 2000.

The labor force participation rates in alternatives I and III are based on those in alternative II-B. In alternative I, each rate by age was raised initially by two percentage points for women and by one point for men. A further adjustment was made for women, so as to reflect the higher assumed fertility; this was based on the assumption that, for each additional baby born during the year, one less woman would be in the labor force in that year. In alternative III, each rate by age was decreased initially by two percentage points for women and by one point for men. For women, the rates by age were increased to reflect the lower assumed fertility.

Under alternative I, coverage rates for men are projected to increase for all ages except 40-44, 50-54, and 70 and over, for which very small decreases are projected. Under alternatives II-A and II-B, they are projected to increase slightly for all ages except 50-64 and 70 and over, for which small decreases are projected. Under alternative III, they are projected to increase slightly for all ages except 40-44, 50-64, and 70 and over, for which no change or small decreases are projected. Under each alternative, the projected coverage rates for women increase substantially for all ages over 15, thereby reflecting the projected increase in labor force participation of women.

TAXABLE PAYROLL

The taxable payroll is defined as that amount which, when multiplied by the combined employee-employer tax rate, yields the total amount of taxes paid by employees, employers, and the self-employed. When the cost of the OASDI program is expressed as a percentage of taxable payroll, it can be compared directly with the combined OASDI employee-employer tax rate to determine whether the system is operating at a surplus or deficit.

In practice, the taxable payroll is calculated as a weighted average of the earnings on which employees, employers, and self-employed persons are taxed. The weighting takes into account the lower tax rates on self-employment income, on tips, and on multiple-employer "excess wages," as compared with the combined employee-employer rate. For 1981-90, the amounts of earnings for employees, employers, and the self-employed were projected separately. After 1990, the amounts of earnings taxable for employees, employers, and the self-employed were each assumed to increase at the compounded rate of the estimated increases in covered workers and in average wages in covered employment.

Another way to measure the cost of the program is as a percentage of the Gross National Product (GNP). Such percentages (which are shown in Table 29) are based on the estimated cost rates and on the assumed ratios of taxable payroll to GNP which are presented in Table A3. The GNP series was determined by applying a series of factors to the assumed ratio of total employee compensation in the economy to GNP. The ratio of total employee compensation in the economy to GNP was

used as the initial point because it is a measure of the share of output going to workers. This ratio is also a convenient starting point because it has changed slowly over time and can be expected to remain fairly constant. Total employee compensation in the economy was related to taxable payroll by means of factors which adjust for various differences in the two measures. The factors adjust total employee compensation by removing supplements to wages and salaries; removing wages and salaries earned in noncovered employment; removing wages, salaries, and self-employment income earned above the taxable base; and adjusting for the lower tax rates on self-employment income, on tips, and on multiple-employer "excess wages."

The ratio of taxable payroll to GNP has risen since 1960, in part because of the increases made in the contribution and benefit base. The long-range trend, however, is more likely to be downward because of increases in fringe benefits, both public and private, which are not included in taxable payroll.

TABLE A3.—RATIO OF TAXABLE PAYROLL TO GNP UNDER ALTERNATIVES I, II-A, II-B, AND III, CALENDAR YEARS 1960-2055

Calendar year	Past experience			
1960	0.396			
1965 .....	.351			
1970 .....	.412			
1975 .....	.424			
1980 .....	.437			
	Projected, by alternative			
	I	II-A	II-B	III
1981	0.440	0.440	0.440	0.440
1985 .....	.431	.430	.428	.424
1990 .....	.424	.426	.420	.413
1995 .....	.422	.421	.411	.407
2000 .....	.416	.414	.403	.398
2005 .....	.410	.408	.395	.390
2010 .....	.405	.402	.388	.383
2015 .....	.399	.397	.380	.376
2020 .....	.393	.391	.373	.368
2025 .....	.388	.386	.366	.362
2030 .....	.382	.380	.359	.355
2035 .....	.377	.375	.352	.348
2040 .....	.371	.369	.346	.341
2045 .....	.366	.364	.339	.335
2050 .....	.361	.359	.333	.329
2055 .....	.356	.354	.327	.323

Note: The definitions of alternatives I, II-A, II-B, and III and taxable payroll are presented in the text.

INSURED POPULATION

There are three types of insured statuses under the OASDI program: fully, currently, and disability insured. Fully insured status is required of an aged worker for eligibility for a primary retirement benefit and for the eligibility of other persons to auxiliary benefits based on the worker's earnings. Fully insured status is also required of a deceased worker for survivors' eligibility for benefits (with the exception of child survivors and parents of eligible child survivors, who may alternatively be eligible if the deceased worker had currently insured status). Disability insured status, which is more restrictive than fully insured status, is required of a disabled worker for eligibility for a primary benefit and for the eligibility of other persons to auxiliary benefits based on the worker's earnings.

Projections of the percentage of the population which is fully insured were made by age and sex based on past and projected coverage rates, the requirement for fully insured status, and the historical relationship between these factors. Currently insured status was disregarded in the cost projection, because the number of cases in which eligibility for benefits is based solely on currently insured status is relatively small. Projections of the percentage of the population who are disability insured were developed from the percentages who are fully insured by using projections of historical trends relating the two. Finally, the fully insured and disability insured populations were developed from the projected total population by applying the percentages fully insured and disability insured.

The fully insured population by age and sex was further subdivided by marital status, in a manner consistent with the division of the total population by marital status. For males, it was assumed that the probability of being fully insured would not vary by marital status. For females, the probability of being fully insured was assumed to vary by marital status as follows: (1) single and divorced women were assumed to be more likely to be fully insured than married women or widowed women, but less likely to be fully insured than men, and (2) widowed women were assumed to be more likely to be fully insured than married women. The relative difference between a widowed woman's probability of being fully insured and a married woman's probability of being fully insured was assumed to decrease through time, reflecting the projected large increase in labor force participation among married women.

OLD-AGE AND SURVIVORS INSURANCE BENEFICIARIES

Several types of benefits, at different benefit levels, are payable under the OASI program. Hence, the numbers of beneficiaries were projected by type of benefit.

The projected numbers of retired-worker beneficiaries were based on the projected aged fully insured population. The percentages, by age and sex, of the insured population which were receiving benefits at the beginning of 1981 were projected to increase gradually on the basis of past trends (after adjustments for changes in the earnings test, in the mandatory retirement age, and in the level of unemployment). The proportions of retired-worker beneficiaries to aged population show gradual increases in the implicit retirement rates.

The number of wife beneficiaries aged 62 and over of retired-worker beneficiaries was estimated from the population projection by marital and insured status. All uninsured wives aged 62 and over—excluding those having husbands not receiving retired-worker benefits, those withheld according to the earnings test, and those eligible for a government pension from earnings in noncovered employment—were assumed to receive benefits. The number of husband beneficiaries aged 62 and over of retired-worker beneficiaries was estimated in an analogous manner.

The projected numbers of child beneficiaries of retired-worker beneficiaries were based on projected ratios of the number of such child beneficiaries to the number of retired workers by sex of worker, adjusted to reflect the fertility assumptions.

The number of young-wife beneficiaries was estimated by extrapolating the base-year ratio of the number of such beneficiaries to the estimated number of child beneficiaries of male retired-worker beneficiaries. The extrapolation reflects projected fertility and female labor force participation. Young-husband beneficiaries were not taken into account, because of the negligible cost involved.

The number of widow beneficiaries aged 60 and over was estimated from the population by marital and insured status. All uninsured widows aged 60 and over, excluding those whose deceased husbands were not fully insured, those withheld according to the earnings test, and those eligible for a government pension from earnings in noncovered employment, were assumed to receive benefits. In addition, some insured widows who had not applied for retired-worker benefits were assumed to receive widow benefits. The number of widower beneficiaries was estimated in an analogous manner.

The numbers of paternal, maternal, and full orphans under age 22 in the United States were estimated from the projected population at those ages by applying age-specific probabilities of being an orphan. These probabilities were derived by using distributions of age of parent at birth of child and death rates consistent with the population projections. To estimate the number of child-survivor beneficiaries, the number of orphans was adjusted to include eligible disabled orphans aged 18 and over and to eliminate orphans of uninsured deceased parents. For nondisabled children aged 18-21, a further reduction was made to exclude those not attending school.

The number of mother beneficiaries was estimated by a method similar to the one used to estimate the number of young-wife beneficiaries—i.e., extrapolating the present ratio of such beneficiaries to child-survivor beneficiaries (excluding those nondisabled children aged 18-21 who were attending school). The number of father beneficiaries was estimated in an analogous manner.

The number of parent beneficiaries was projected on the basis of the past trend in the number of such beneficiaries. A decrease was assumed from 15,000 at the beginning of 1980 to an ultimate level of 7,000 in 1995.

Table A4 shows the estimated numbers of beneficiaries under the OASI program. Included among the beneficiaries who receive retired-worker benefits are some persons who also receive residual benefits consisting of the excess of any potential auxiliary benefits over their own retired-worker benefit. Estimates of the number of such residual payments were made separately for wives, widows, husbands, and widowers. Residual payments to other beneficiaries were not taken into account, because of the negligible cost involved.

TABLE A4.—OASI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF JUNE 30 UNDER ALTERNATIVES I, II-A, II-B, AND III, CALENDAR YEARS 1960-2055
[In thousands]

Calendar year	Retired workers and auxiliaries			Survivors				Total
	Worker	Wife- husband	Child	Widow- widower	Mother- father	Child	Parent	
1960.....	7,813	2,224	260	1,471	388	1,549	35	13,740
1965.....	10,843	2,601	429	2,228	472	1,900	36	18,509
1970.....	13,066	2,651	535	3,151	514	2,673	29	22,618
1975.....	16,210	2,836	633	3,823	568	2,905	22	26,998
1976.....	16,789	2,867	638	3,939	576	2,911	21	27,740
1977.....	17,380	2,899	670	4,042	573	2,843	19	28,428
1978.....	17,924	2,942	662	4,147	569	2,800	18	29,062
1979.....	18,590	2,966	651	4,260	567	2,739	17	29,789
1980.....	19,167	2,987	633	4,354	560	2,668	15	30,384
Alternative I:								
1981.....	19,790	3,013	635	4,446	554	2,620	14	31,072
1985.....	22,430	3,105	614	4,663	537	2,338	10	33,697
1990.....	25,526	3,178	616	4,828	520	2,210	8	36,886
1995.....	26,875	3,238	573	4,694	579	2,315	7	38,281
2000.....	27,955	3,153	585	4,555	612	2,413	7	39,280
2005.....	29,558	3,107	633	4,430	615	2,464	7	40,814
2010.....	32,726	3,162	739	4,323	609	2,495	7	44,061
2015.....	37,689	3,312	884	4,263	618	2,549	7	49,322
2020.....	43,509	3,477	994	4,276	630	2,656	7	55,549
2025.....	49,323	3,591	1,039	4,364	627	2,765	7	61,716
2030.....	53,111	3,530	1,052	4,424	632	2,852	7	65,608
2035.....	54,623	3,364	1,020	4,462	650	2,929	7	67,055
2040.....	54,310	3,135	976	4,444	677	3,015	7	68,564
2045.....	54,239	3,026	983	4,379	702	3,121	7	66,457
2050.....	55,240	3,068	1,034	4,315	723	3,240	7	67,627
2055.....	56,765	3,162	1,076	4,261	743	3,351	7	69,365
Alternative II-A:								
1981.....	19,790	3,013	635	4,446	554	2,620	14	31,072
1985.....	22,495	3,114	614	4,699	533	2,321	10	33,786
1990.....	25,846	3,220	617	4,927	503	2,139	8	37,260
1995.....	27,618	3,373	579	4,785	543	2,171	7	39,076
2000.....	29,131	3,342	591	4,699	553	2,181	7	40,504
2005.....	31,160	3,348	633	4,602	543	2,156	7	42,449
2010.....	34,756	3,446	723	4,530	528	2,119	7	46,109
2015.....	40,212	3,640	856	4,481	529	2,109	7	51,834
2020.....	46,576	3,874	986	4,515	530	2,136	7	58,624
2025.....	53,039	4,061	1,088	4,584	520	2,171	7	65,470
2030.....	57,552	4,032	1,103	4,668	514	2,186	7	70,062
2035.....	59,799	3,892	1,074	4,743	516	2,191	7	72,222
2040.....	60,165	3,677	1,034	4,762	524	2,199	7	72,368
2045.....	60,663	3,569	1,049	4,761	529	2,218	7	72,796
2050.....	61,849	3,575	1,095	4,717	530	2,243	7	74,016
2055.....	63,092	3,632	1,128	4,649	532	2,265	7	75,305

TABLE A4.—OASI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF JUNE 30 UNDER ALTERNATIVES I, II-A, II-B, AND III, CALENDAR YEARS 1960-2055 (Cont.)
[In thousands]

Calendar year	Retired workers and auxiliaries			Survivors				Total
	Worker	Wife-husband	Child	Widow-widower	Mother-father	Child	Parent	
Alternative II-B:								
1981	19,790	3,013	635	4,446	554	2,620	14	31,072
1985	22,429	3,111	614	4,706	533	2,321	10	33,724
1990	25,646	3,209	617	4,945	503	2,139	8	37,067
1995	27,615	3,373	579	4,785	543	2,171	7	39,073
2000	29,129	3,342	591	4,699	553	2,181	7	40,502
2005	31,154	3,345	633	4,602	543	2,156	7	42,440
2010	34,750	3,444	723	4,531	528	2,119	7	46,102
2015	40,187	3,649	856	4,487	529	2,109	7	51,824
2020	46,544	3,884	986	4,517	530	2,136	7	58,604
2025	53,001	4,080	1,088	4,601	520	2,171	7	65,468
2030	57,513	4,048	1,103	4,675	514	2,186	7	70,046
2035	59,765	3,907	1,074	4,754	516	2,191	7	72,214
2040	60,140	3,689	1,034	4,775	524	2,199	7	72,368
2045	60,624	3,580	1,049	4,773	529	2,218	7	72,780
2050	61,832	3,582	1,095	4,722	530	2,243	7	74,011
2055	63,074	3,636	1,128	4,665	532	2,265	7	75,307
Alternative III:								
1981	19,790	3,013	635	4,446	554	2,620	14	31,072
1985	22,479	3,126	615	4,783	526	2,288	10	33,827
1990	26,157	3,284	618	5,146	474	2,012	8	37,699
1995	29,084	3,619	599	4,962	484	1,939	7	40,694
2000	31,483	3,704	607	4,969	463	1,8387	43,071	
2005	34,408	3,800	634	4,966	433	1,730	7	45,978
2010	38,941	3,995	717	4,977	414	1,627	7	50,678
2015	45,409	4,290	837	5,009	407	1,557	7	57,516
2020	52,929	4,640	991	5,092	398	1,516	7	65,573
2025	60,748	4,931	1,178	5,214	384	1,483	7	73,945
2030	66,767	4,994	1,200	5,336	370	1,444	7	80,118
2035	70,605	4,907	1,183	5,485	359	1,395	7	83,941
2040	72,582	4,701	1,149	5,599	352	1,349	7	85,739
2045	74,545	4,580	1,173	5,717	341	1,308	7	87,671
2050	76,694	4,514	1,220	5,814	330	1,279	7	89,858
2055	78,143	4,439	1,236	5,849	318	1,246	7	91,238

Note: The definitions of alternatives I, II-A, II-B, and III are presented in the text.

DISABILITY INSURANCE BENEFICIARIES

The number of disabled-worker beneficiaries was projected from the exposed population, which was developed from the disability insured population by removing those persons already entitled to disabled-worker benefits. The number of newly entitled beneficiaries was developed from the exposed population by applying disability incidence rates. To obtain the number of currently entitled beneficiaries, termination rates were applied to the population consisting of the newly entitled beneficiaries and those already currently entitled.

The incidence rates were projected by age, sex, and year of exposure to disability. Although disability awards declined by approximately 5 percent during 1980, age-sex specific incidence rates were assumed to increase over the period 1981-2000, to a level about 15 percent higher than the average for 1978-80 and to remain constant thereafter.

The termination rates were estimated by age, sex, and duration of entitlement. The mortality rates used throughout the projection period were assumed to be the same as those experienced by disabled-worker beneficiaries during 1976-79. The recovery rates were assumed to be 20 percent higher than those of the same period, thereby allowing for the assumed effect of the Disability Amendments of 1980. All disabled-worker benefits terminate at age 65, when retired-worker benefits become payable.

The number of children entitled to benefits was projected as a proportion of the number of disabled-worker beneficiaries, by sex, based on recent experience and allowing for projected changes in fertility.

The number of young-wife beneficiaries was projected as a proportion of the number of child beneficiaries of male disabled-worker beneficiaries, based on recent experience and allowing for projected changes in fertility and female labor force participation. The number of young-husband beneficiaries was projected in an analogous manner.

The number of aged-wife beneficiaries was projected as a proportion of the number of male disabled-worker beneficiaries. The number of aged-husband beneficiaries was projected in an analogous manner.

Table A5 shows the projected number of beneficiaries in the DI program.

TABLE A5.—DI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF JUNE 30 UNDER ALTERNATIVES I, II-A, II-B, AND III, CALENDAR YEARS 1960-2055
[In thousands]

Calendar year	Disabled workers	Dependents of disabled workers			Total
		Wives and husbands	Children		
1960	371	56	94	522	
1965	944	187	518	1,648	
1970	1,436	271	861	2,568	
1975	2,363	429	1,333	4,125	
1976	2,602	468	1,462	4,533	
1977	2,755	482	1,496	4,733	
1978	2,858	491	1,512	4,861	
1979	2,877	483	1,466	4,826	
1980	2,863	468	1,403	4,734	
Alternative I:					
1981	2,857	454	1,386	4,697	
1985	2,758	435	1,282	4,475	
1990	2,917	410	1,211	4,538	
1995	3,005	413	1,185	4,603	
2000	3,376	445	1,301	5,122	
2005	3,872	316	1,206	5,394	
2010	4,316	366	1,292	5,974	
2015	4,576	410	1,370	6,356	
2020	4,646	433	1,448	6,527	
2025	4,532	427	1,472	6,431	
2030	4,373	406	1,438	6,217	
2035	4,380	397	1,439	6,216	
2040	4,560	401	1,509	6,470	
2045	4,810	412	1,630	6,852	
2050	4,971	423	1,711	7,105	
2055	5,079	433	1,745	7,257	
Alternative II-A:					
1981	2,857	454	1,386	4,697	
1985	2,785	439	1,295	4,519	
1990	3,053	430	1,267	4,750	
1995	3,325	432	1,257	5,014	
2000	3,824	472	1,394	5,690	
2005	4,438	404	1,511	6,353	
2010	4,976	475	1,606	7,057	
2015	5,289	535	1,685	7,509	
2020	5,373	569	1,761	7,703	
2025	5,228	568	1,765	7,561	
2030	5,017	542	1,691	7,250	
2035	4,985	531	1,657	7,173	
2040	5,120	532	1,700	7,352	
2045	5,296	540	1,792	7,628	
2050	5,344	543	1,834	7,721	
2055	5,329	544	1,824	7,697	

TABLE A5.—DI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF JUNE 30 UNDER ALTERNATIVES I, II-A, II-B, AND III, CALENDAR YEARS 1960-2055 (Cont.)
[in thousands]

Calendar year	Dependents of disabled workers			Total
	Disabled workers	Wives and husbands	Children	
Alternative II-B:				
1981	2,857	454	1,386	4,697
1985	2,785	439	1,295	4,519
1990	3,053	430	1,267	4,750
1995	3,325	432	1,257	5,014
2000	3,322	472	1,392	5,686
2005	4,435	404	1,510	6,349
2010	4,975	475	1,606	7,056
2015	5,286	535	1,685	7,506
2020	5,369	568	1,760	7,697
2025	5,225	568	1,765	7,558
2030	5,015	542	1,690	7,247
2035	4,983	531	1,656	7,170
2040	5,119	532	1,699	7,350
2045	5,294	540	1,792	7,626
2050	5,343	543	1,834	7,720
2055	5,328	544	1,824	7,696
Alternative III:				
1981	2,856	454	1,385	4,696
1985	2,810	442	1,307	4,560
1990	3,187	448	1,322	4,958
1995	3,611	437	1,307	5,355
2000	4,251	474	1,450	6,175
2005	4,996	547	1,890	7,433
2010	5,637	650	1,981	8,268
2015	6,009	743	2,045	8,797
2020	6,104	801	2,100	9,005
2025	5,922	809	2,063	8,794
2030	5,644	779	1,921	8,344
2035	5,541	769	1,825	8,135
2040	5,587	767	1,814	8,168
2045	5,619	769	1,852	8,240
2050	5,471	755	1,830	8,056
2055	5,252	732	1,755	7,739

Note: The definitions of alternatives I, II-A, II-B, and III are presented in the text.

AVERAGE WAGES AND INFLATION

Future increases in the Consumer Price Index and in average wages will directly affect the OASDI program, because of the automatic adjustment provisions in the law which require that benefit payments be adjusted to reflect increases in the CPI and that the benefit formula, the taxable earnings base, the exempt amount in the earnings test, and the amount of earnings required for a quarter of coverage be adjusted to reflect increases in average wages.

The ultimate real-wage differentials were based on projections of productivity gains and of the factors linking productivity gains with the real-wage differential. Since 1951, annual increases in productivity have averaged 2.3 percent, the result of average increases of 2.6 percent, 2.8 percent, and 1.4 percent during the 1950's, the 1960's, and the 1970's, respectively. Meanwhile, the real-wage differential has averaged 1.3 percent since 1951, the result of average increases of 2.7 percent, 1.7 percent, and -0.4 percent during the 1950's, the 1960's, and the 1970's, respectively. The difference between increases in productivity and the real-wage differential, which has averaged roughly 1.0 percent since 1951, results from changes in such factors as the average number of hours worked per year, the degree to which employees share in productivity gains, and the proportion of employee compensation reflected in wages. The ultimate annual adjustment from these factors is assumed to be 0.50 percent in alternatives I and II-A and 0.75 percent in

alternatives II-B and III. The lower adjustment in alternatives I and II-A reflects the more robust economic experience assumed in those alternatives which results in a longer work week and an increase in the portion of employee compensation that is taxable for OASDI purposes. In alternative II-A, the ultimate annual increase in productivity is assumed to be 2.50 percent, which is consistent with the relatively high level of economic growth assumed. In alternative II-B, the ultimate annual increase in productivity is assumed to be 2.25 percent, which is close to the level experienced over the period 1951-80. These assumptions yield ultimate real-wage differentials of 2.0 percent and 1.5 percent for alternatives II-A and II-B, respectively. The ultimate real-wage differentials for alternatives I and III are assumed to be 2.5 percent and 1.0 percent, respectively. The ultimate real-wage differentials are assumed to be attained by the year 1992.

In alternative II-A, the CPI was assumed to increase ultimately at an annual rate of 3 percent, which assumes that the effective use of monetary policy will become more prevalent in the future. In alternative II-B, the CPI was assumed to increase ultimately at an annual rate of 4 percent, which is slightly lower than the average of 4.2 percent experienced over the last 30 years. The ultimate increases in the average annual CPI under alternatives I and III of 2 percent and 5 percent, respectively, were chosen so as to include a reasonable range of possible values.

The ultimate increases in average annual wages in covered employment were assumed to be 4.5, 5.0, 5.5, and 6.0 percent, for alternatives I, II-A, II-B, and III, respectively. These were obtained by adding the corresponding annual percentage increases in the CPI to the assumed real-wage differentials for each alternative.

AVERAGE BENEFITS

Future increases in the amount of the average retired-worker benefit awarded were projected by simulating the automatic benefit adjustment provisions and calculating future benefits for workers, by sex, at various earnings levels. Future increases in the average male and female retired-worker benefits in current-payment status were projected on the basis of the distribution of current beneficiaries by year of award, their average awarded benefits, and the increase in their benefits since the year of award. The average male and female disabled-worker benefits were projected similarly.

The average benefits for all persons receiving OASI or DI monthly benefits based on the earnings records of male workers (except recipients of residual payments to wives, widows, husbands, and widowers) were projected to increase at the same rate as the average male retired-worker or disabled-worker benefit, respectively. Similarly, the average benefits for all persons receiving OASI or DI monthly benefits based on the earnings records of female workers were assumed to increase at the same rate as the average female retired-worker or disabled-worker benefit, respectively.

BENEFIT PAYMENTS

For each category of beneficiary, monthly benefit payments were calculated as the product of the number of beneficiaries and the

corresponding average benefit. These amounts were then adjusted to include retroactive payments to newly awarded beneficiaries. Retroactive payments result from delays between the date of filing for benefits and the date of first payment, as well as from a provision in the law which allows a beneficiary to receive up to 6 months' benefits (or 12 months' benefits for disabled widows and widowers and for all DI beneficiaries) retroactively from the date of initial entitlement to benefits, on the condition that benefits are not thereby permanently reduced for early retirement.

Lump-sum death payments were calculated as the product of the number of such payments (which was projected by applying the assumed mortality rates to the projected fully insured population) and the amount of the lump-sum death payment (\$255).

ADMINISTRATIVE EXPENSES

The projection of administrative expenses through 1990 was based on assumed increases in average wages, increases in the CPI, and increases in the number of beneficiaries. For years after 1990, administrative expenses were assumed to increase at approximately the compounded rate of the estimated increases in the number of beneficiaries and in average wages in covered employment.

RAILROAD RETIREMENT FINANCIAL INTERCHANGE

The effect of the financial interchange with the Railroad Retirement program was evaluated on the basis of trends similar to those used in estimating the cost of the OASDI benefits. The resulting effect was an average annual long-range cost to the OASDI system of 0.01 percent of taxable payroll.

REIMBURSEMENT FOR NONCONTRIBUTORY CREDITS

Reimbursement from the general fund of the Treasury for noncontributory credits for military service has not been reflected in the cost estimates. The reduction of cost resulting from such reimbursement is estimated to be about 0.05 percent of taxable payroll currently, and to decrease as a percentage of taxable payroll until about 2015, after which it is negligible.

Reimbursement from the general fund of the Treasury for special benefits paid to certain persons aged 72 and over has not been reflected in the cost estimates. The reduction in cost resulting from such reimbursement is estimated to be 0.01 percent of taxable payroll currently, and to decrease to a negligible amount after 1984.

APPENDIX B.—SENSITIVITY ANALYSIS

This appendix illustrates the sensitivity of the medium-range and long-range cost estimates to changes in selected individual assumptions. Although the estimates under alternatives I, II-A, II-B, and III illustrate the variations in the projected cost of the OASDI program resulting from different combinations of assumptions, they do not show the variations resulting from changes in any single assumption. In the sensitivity analysis, alternative II-B is used as an illustrative set of assumptions. For each sensitivity test, only one assumption within that alternative is varied, and the resulting range of cost rates is estimated. Similar variations in the selected assumptions within alternatives I, II-A, and III would result in similar variations in cost rates (when expressed as percentage variations).

TOTAL FERTILITY RATE

Table B1 shows the estimated average cost rate under alternative II-B with various assumed ultimate total fertility rates. Those rates are 1.7 children per woman (as in alternative III), 2.1 (as in alternatives II-A and II-B), and 2.4 (as in alternative I). The rates are assumed to change gradually from their current levels and to reach their ultimate values in 2005.

TABLE B1.—ESTIMATED AVERAGE COST RATE OF OASDI SYSTEM UNDER ALTERNATIVE II-B WITH VARIOUS FERTILITY ASSUMPTIONS
[As percent of taxable payroll]

Calendar years	Ultimate total fertility rate ^a		
	1.7	2.1	2.4
1981-2005.....	11.52	11.51	11.51
2006-2030.....	14.52	13.87	13.46
2031-2055.....	19.75	16.81	15.09
1981-2055.....	15.26	14.07	13.35

^aThe total fertility rate for a given year is the number of children a woman would have during her lifetime if she were to experience the age-specific birth rates observed in that year and were to survive the entire child-bearing period. Ultimate rates are assumed to be attained by 2005.

Note: The definitions of alternative II-B and taxable payroll are presented in the text.

Over the medium-range period, the estimated average cost rate is nearly identical under the three fertility assumptions, varying only from 11.51 percent of taxable payroll (for 2.4 children per woman) to 11.52 percent (for 1.7 children per woman). By contrast, the estimated average long-range cost rate varies over a wide range, from 13.35 to 15.26 percent.

During the medium-range period, changes in fertility affect the working population only slightly and result in relatively minor changes in the number of child beneficiaries. Hence, the program cost is affected only slightly. Later in the 75-year period, however, under higher fertility, the labor force increases faster than the beneficiary population, so that the estimated average long-range cost rate decreases with increasing fertility.

MORTALITY

Table B2 shows the estimated average cost rate under alternative II-B with various assumptions about future mortality improvement, as meas-

ured by the percentage decrease from 1978 to 2055 in the age-sex-adjusted death rate. Those assumptions are that mortality will improve by about 22 percent (as in alternative I), 36 percent (as in alternatives II-A and II-B), and 58 percent (as in alternative III).

TABLE B2.—ESTIMATED AVERAGE COST RATE OF OASDI SYSTEM UNDER ALTERNATIVE II-B WITH VARIOUS MORTALITY ASSUMPTIONS
[As percent of taxable payroll]

Calendar years	Mortality improvement ¹		
	22 percent	36 percent	58 percent
1981-2005.....	11.35	11.51	11.86
2006-2030.....	13.25	13.87	15.23
2031-2055.....	15.57	16.81	19.53
1981-2055.....	13.39	14.07	15.54

¹The mortality improvement is the percentage decrease from 1978 to 2055 in the age-sex-adjusted death rate.

Note: The definitions of alternative II-B and taxable payroll are presented in the text.

Over the medium-range period, the estimated average cost rate increases with increasing mortality improvement from 11.35 percent of taxable payroll (for 22 percent mortality improvement) to 11.86 percent (for 58 percent improvement). Over the long-range period, a similar but more pronounced trend exists. The estimated average long-range cost rate increases from 13.39 to 15.54 percent.

The estimated average cost rate increases with increasing improvement in mortality because of the relationship between age and mortality. Any mortality improvement in the population over age 65, where mortality rates are the highest, extends the length of time that retirement benefits are paid. At ages 50-64, mortality improvement results in an increase in tax income, but this is more than offset by the resulting increase in benefits payable to the additional retirees at age 65. At ages 20-49, mortality rates are so low that even substantial improvement in the rates would not result in significant increases in the number of covered workers. Mortality improvement at ages under 20 has relatively little long-term effect on the relationship between income and outgo. Consequently, the net effect of mortality improvement is to increase outgo more than taxable income, thereby resulting in higher cost rates.

DISABILITY INCIDENCE RATES

Table B3 shows the estimated average cost rate under alternative II-B with various disability incidence rate assumptions. Those assumptions are that the ultimate disability incidence rates by age and sex will differ from the average rates by age and sex experienced in 1978-80 as follows: they will be about the same (as in alternative I), about 15 percent higher (as in alternatives II-A and II-B), and about 30 percent higher (as in alternative III). The rates are assumed to change gradually from their current levels and to reach their ultimate values in 2000.

TABLE B3.—ESTIMATED AVERAGE COST RATE OF OASDI SYSTEM UNDER ALTERNATIVE II-B WITH VARIOUS DISABILITY INCIDENCE ASSUMPTIONS
[As percent of taxable payroll]

Calendar years	Disability incidence rate increase ¹		
	None	15 percent	30 percent
1981-2005	11.42	11.51	11.60
2006-2030	13.66	13.87	14.08
2031-2055	16.60	16.81	17.02
1981-2055	13.89	14.07	14.23

¹The disability incidence rate increase is based on the ratio of the age-sex-adjusted incidence rate in 2000 and later to such rate during 1978-80, with an adjustment to reflect the effects of the Disability Amendments of 1980.

Note: The definitions of alternative II-B and taxable payroll are presented in the text.

Over the medium-range period, the estimated average cost rate varies with changing disability incidence from 11.42 percent of taxable payroll (for no increase) to 11.60 percent (for 30 percent increase). Over the long-range period, it varies from 13.89 percent to 14.23 percent.

CONSUMER PRICE INDEX

Table B4 shows the estimated average cost rate under alternative II-B with various CPI assumptions. These assumptions are that the ultimate annual CPI increase will be 2 percent (as in alternative I), 3 percent (as in alternative II-A), 4 percent (as in alternative II-B), 5 percent (as in alternative III), and 6 percent. In each case the ultimate real-wage differential is assumed to be 1.5 percent, yielding ultimate percentage increases in average annual wages of 3.5, 4.5, 5.5, 6.5, and 7.5 percent, respectively. The annual CPI increase is assumed to change gradually from its current level and to reach its ultimate value in 1990.

TABLE B4.—ESTIMATED AVERAGE COST RATE OF OASDI SYSTEM UNDER ALTERNATIVE II-B WITH VARIOUS CONSUMER PRICE INDEX ASSUMPTIONS
[As percent of taxable payroll]

Calendar years	Ultimate percentage increase in wages-CPI ¹				
	3.5-2	4.5-3	5.5-4	6.5-5	7.5-6
1981-2005	11.68	11.59	11.51	11.44	11.36
2006-2030	14.21	14.04	13.87	13.72	13.56
2031-2055	17.22	17.02	16.81	16.62	16.44
1981-2055	14.37	14.22	14.07	13.93	13.79

¹The first value in each pair is the assumed annual percentage increase in average wages in 1991 and later years. The second value is the assumed annual percentage increase in CPI in 1990 and later years. The assumptions used in earlier years gradually merge into the ultimate values.

Note: The definitions of alternative II-B and taxable payroll are presented in the text.

Over both the medium-range and long-range periods, the estimated average cost rate varies as the assumed rate of change in the CPI increases. Over the medium range, the estimated average cost rate decreases from 11.68 percent of taxable payroll (for CPI increases of 2 percent) to 11.36 percent (for CPI increases of 6 percent). Over the long-range, it varies from 14.37 percent to 13.79 percent.

The relationship described above results primarily from the time lag between the effect on income and on benefit outgo. When assuming a higher rate of increase in the CPI (in conjunction with a constant real-wage differential), the effect on income of the implied higher rate of increase in wages is experienced immediately, while the effect on

benefits of the higher rate of increase in the CPI is experienced with about a half-year lag. In addition, the earliest effect on benefits of the higher rate of increase in wages is experienced with about a 2-year lag.

REAL-WAGE DIFFERENTIAL

Table B5 shows the estimated average cost rate under alternative II-B with various real-wage assumptions. These assumptions are that the ultimate real-wage differential will be 1 percent (as in alternative III), 1.5 percent (as in alternative II-B), 2 percent (as in alternative II-A), and 2.5 percent (as in alternative I). In each case the ultimate annual CPI increase is assumed to be 4 percent, yielding ultimate percentage increases in average annual wages of 5, 5.5, 6, and 6.5 percent, respectively. The real-wage differential is assumed to change gradually from its current level and to reach its ultimate value in 1991.

TABLE B5.—ESTIMATED AVERAGE COST RATE OF OASDI SYSTEM UNDER ALTERNATIVE II-B WITH VARIOUS REAL-WAGE ASSUMPTIONS
[As percent of taxable payroll]

Calendar years	Ultimate percentage increase in wages-CPI ¹			
	5-4	5.5-4	6-4	6.5-4
1981-2005	11.93	11.51	11.12	10.75
2006-2030	14.77	13.87	13.06	12.31
2031-2055	18.03	16.81	15.73	14.72
1981-2055	14.91	14.07	13.30	12.59

¹The first value in each pair is the assumed annual percentage increase in average wages in 1991 and later years. The second value is the assumed annual percentage increase in CPI in 1990 and later years. The difference between the two values is the real-wage differential. The assumptions used in earlier years gradually merge into the ultimate values.

Note: The definitions of alternative II-B and taxable payroll are presented in the text.

Over the medium-range period, the estimated average cost rate varies from 11.93 percent of taxable payroll (for real-wage differentials of 1 percent) to 10.75 percent (for differentials of 2.5 percent). Over the long-range period, it varies from 14.91 percent to 12.59 percent.

The average cost rate decreases with increasing real-wage differentials for two reasons. One is that there is a lag between the time when workers pay taxes based on the higher earnings and the time when they draw benefits based on those earnings. The other is that the benefits to those already eligible—benefits which increase according to the increase in the CPI, not wages—are smaller relative to the payrolls based on the higher real-wage differentials.